

Curiosity's investigation of the Bagnold Dunes, Gale crater: Overview of a two-phase scientific campaign

M.G.A. Lapotre¹ & E.B. Rampe²

¹Department of Earth and Planetary Sciences, Harvard University, Cambridge, MA 02138, USA.

²Astromaterials Research and Exploration Science Division, NASA Johnson Space Center, Houston, TX 77058, USA.

The Mars Science Laboratory (MSL) Curiosity rover landed at Gale crater in August 2012 with the goal of unravelling the climate and habitability history of ancient Mars. On its way to higher stratigraphic levels of Aeolis Mons, the crater's central mound, Curiosity crossed an active dune field informally named the Bagnold Dune Field. Curiosity's traverse through the Bagnold Dunes between December 2015 and April 2017 constituted the first in situ investigation of an active dune field on another planet. The scientific campaign at the dunes enabled a detailed study of martian eolian processes at scales that are unachievable from orbiter-based imagery, from the scale of compound bedforms down to those of individual sand grains. The eolian-science campaign was broadly divided into two main phases – a first-phase investigation near two barchan dunes along the northern trailing edge of the dune field, Namib and High Dunes, and a second-phase investigation farther south near a linear dune, the Nathan Bridges Dune, named after our beloved colleague and friend Nathan Bridges. In addition to these two phases, the Bagnold Dunes campaign included punctual investigations of isolated ripples and ripple fields further along the rover traverse away from the Bagnold Dune Field. The main goals of the scientific investigation at the Bagnold Dunes were two-fold: (I) developing a mechanistic understanding of martian eolian processes and rates from direct in situ observations of eolian structures and their dynamics, and (II) characterizing the physical properties and the chemical and mineral composition of eolian sands and dust on Mars. Significant advances in martian eolian science resulted from Curiosity's ground investigation of the active Bagnold Dunes. Altogether, results from the Bagnold Dunes campaign are key to understanding how the martian environment affects eolian processes, and will thus prove most useful to deciphering paleoenvironments from the martian eolian sedimentary record.